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# Developing sustainable and resilient transport systems in view of emerging challenges

## Note by the UNCTAD secretariat

*Executive summary*

This note discusses some considerations to bear in mind when developing sustainable and resilient freight transport systems. Relevant considerations relate in particular to trends in global economic growth, demography, investment, technology, energy, transportation costs, and more importantly, climate change and the environment.

The special case of the geographically disadvantaged and economically vulnerable countries, namely landlocked developing countries (LLDCs) and small island developing States (SIDS) is highlighted in this paper, given the underlying vulnerabilities and the particular sustainable development gaps identified in these countries. An overview of potential actions necessary to catalyse a shift towards more sustainable and resilient freight transport systems and the potential role of UNCTAD in supporting developing countries in these efforts are also discussed.

With a view to providing decision-making and policy-design assistance, in particular to LLDCs and SIDS, reference is made to relevant work carried out by UNCTAD under its three pillars of work, namely research and analysis, consensus-building, technical assistance and capacity-building.

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## Introduction

1. In recent years, multiple, interconnected crises have emerged. These range from global economic and financial meltdowns to the depletion of natural resources, growing environmental risks and climate destabilization.

2. Freight transport, an economic sector in its own right and the backbone of international trade, is directly affected by these trends, complicating the sector's operating landscape. Energy security and costs, as well as climate change and environmental sustainability, call for particular attention, given their implications for sustainable development.

3. Further, freight transport is a key determinant of efficient market access, trade competitiveness and a country's ability to effectively integrate into global supply chains. In its role as an enabler of social and economic advances, freight transport also has the potential to erode some of its own benefits. The sector's heavy reliance on fossil fuels undermines resource conservation objectives, is costly and leads to environmental deterioration. In view of the current unsustainable patterns, it is both necessary and urgent to promote a shift towards more sustainable and more resilient freight transport systems – more sustainable in terms of striking a balance between economic, social and environmental objectives and more resilient in terms of adapting infrastructure, services and operations to a changing climate and environment.

4. Sea shipping, including port infrastructure and services, lies at the heart of the debate on sustainable transport development. With 80 per cent of international merchandise trade by volume and over two thirds by value being carried by sea, achieving sustainability and resilience in maritime transport is a necessary condition for the sustainability and resilience of global freight transport systems. All countries, developed and developing alike, including landlocked and sea-locked countries, depend almost exclusively on shipping to transport their imports and exports.

5. Sustainability principles in freight transport include the need to achieve economic efficiency and viability, safe and secure infrastructures and services, as well as environmentally friendly systems that prevent and minimize negative externalities, such as energy resource depletion, environmental degradation and climate change impacts. In this respect, building resilience to climatic factors entails ensuring system integrity, service reliability and functionality, as well as rapid recovery after disruption. These principles are consistent with the priorities of the Rio+20 Conference and the Millennium Development Goals. In the context of the post-2015 development agenda, there is an opportunity for the freight transport sector to be recognized as a key factor in advancing sustainable development goals, and thereby benefit from being mainstreamed into development policies and funding mechanisms generated by renewed international commitments.

6. The post-2015 development agenda in particular may provide an opportunity for LLDCs and SIDS to set priorities and targets that are specific to their sustainable development objectives. The process also allows the international community to consider the interconnection between energy, environment, and infrastructure and system resilience. In this respect, discussions at the seventh session of the United Nations Open Working Group on Sustainable Development Goals, held from 6–10 January 2014, have underscored the linkages between thematic issues such as sustainable cities and human settlements, sustainable transport, climate change and disaster risk reduction. Discussions have also stressed that climate change and natural disaster risks are cross-cutting issues that undermine development gains, thereby entailing the need for new sustainable development goals, targets and indicators that would address the issue of sustainable and resilient transportation.

7. Against this background, this note discusses some considerations to bear in mind when developing sustainable and resilient freight transport systems. Relevant considerations relate in particular to trends in global economic growth, demography, investment, technology, energy, transportation costs, and more importantly, climate change and the environment. The special case of the geographically disadvantaged and economically vulnerable countries, namely LLDCs and SIDS, is highlighted, given the underlying vulnerabilities and the particular sustainable development gaps identified in these countries. An overview of potential actions necessary to catalyse a shift towards more sustainable and resilient freight transport systems and the potential role of UNCTAD in supporting developing countries in these efforts are also discussed.

# I. Sustainable and resilient transport systems: Some considerations

8. It is increasingly recognized that well-functioning, efficient and resilient freight transport systems are a prerequisite for achieving trade and economic integration, as well as for attracting investment, developing enterprise and building productive capacity. It is equally acknowledged that a number of persistent transport-related challenges are undermining developing countries' effective integration into the global trading system. Relatively higher transport costs in developing regions create an effective barrier to trade that undermines their prospects for growth and sustainable development.

9. The incidence of higher transport costs is more significant in developing countries that specialize in low value goods with little potential for differentiation. It is also significant in rural areas where transport challenges are greater and where access to market places is more difficult. In addition to trade composition and flows, other factors that drive up transport costs include, for example, an inadequate or lacking enabling relevant regulatory framework for transport and trade, deficiencies in transport infrastructure and equipment as well as insufficient technology uptake and integration. These challenges hold some important implications for the sustainability and the resilience of freight transport systems in developing countries.

10. New developments currently affecting transport and trade could also influence ways in which sustainability and resilience principles are mainstreamed into freight transport systems. Relevant trends include the following:

(a) Economic and population growth and related implications in terms of scale, technology and market structure;

(b) An incremental shift in global economic influence by different players and related implications for trade patterns and markets;

(c) Rising and volatile fuel prices and related implications for operating and transport costs;

(d) Growing environmental sustainability and climate change concerns – Improving understanding of the interplay between these trends on the one hand, and sustainability and resilience imperatives on the other, are required for the effective planning and design of sustainable and resilient freight transport systems.

## A. Economic and population growth

11. Demand for freight transportation increases in line with growth in the world population and economic activity. The Organization for Economic Cooperation and Development (OECD) projects that by 2050, world freight flows will be from two to four times above 2010 levels, driven by growth outside OECD, where flows are expected to be between two and six times higher than in 2010.[1] Since 1970, global seaborne trade has expanded at an average annual rate of 3 per cent, reaching an estimated 9.2 billion tons in 2012. At this pace, global seaborne trade is expected to double by 2036. By 2017, the annual cargo throughput of global container terminals is expected to reach 800 million twenty foot equivalent units (TEUs), up from 186 million TEUs handled today.[2] Expected growth raises some scale issues, especially for smaller players in developing regions as larger trade volumes bear implications for ship design and technology, port infrastructure development and market structure.

12. Increasingly larger-sized and highly capital intensive container ships are being built and deployed, while the structure of the container shipping market and the prevailing competition level are being reshaped by the emergence of mega alliances such as the P3 Network alliance (Denmark's Maersk Line, the Swiss-based Mediterranean Shipping Company and CMA CGM of France). For developing countries, issues of scale, competition and access to technology may be problematic, especially in view of the prevailing deficit in transport infrastructure and technology.

## B. Shift in global economic influence

13. Another trend with a bearing on the long-term sustainability and resilience of freight transport systems is the incremental shift of economic influence from advanced economies to developing countries. Developing countries are contributing larger shares to growth and trade, including seaborne trade. In 2012, for example, a total of 60 per cent of world seaborne trade volumes originated in developing countries, and 58 per cent of those volumes were delivered on their territories.

14. Developing countries are moving away from their previous role as loading areas for raw materials and resources and are becoming active players, both as exporters and importers. This shift entails a new geographical distribution of production and consumption centres (that is, changes in distances travelled by cargoes) with implications for transport networks and configurations, fuel consumption, transport costs, emissions and climate change. Consequently, a shift in global economic influence and its ripple effects are likely to influence the sustainability and resilience agenda in freight transport.

## C. Rising and volatile fuel prices

15. Energy security and related implications for oil prices are also an area of concern. Despite new oil and gas reserve discoveries and advances in oil and gas extraction technologies, the era of easy and cheap oil is most likely drawing to an end. As transport systems are fossil-fuel dependent (freight and passenger transportation consume over 50 per

[1] OECD/International Transport Forum, 2012, *Transport Outlook: Seamless Transport for Greener Growth* (Paris).

[2] Drewry Maritime Research, 2013, *Global Container Terminal Operators Annual Review and Forecast 2013* (London).

cent of global liquid fossil fuels)[3] and with international energy demand for commercial transportation projected to increase, the associated implications for transport costs can be challenging to all countries, but even more so for developing countries such as LLDCs and SIDS, where transport costs can be prohibitive.

16. A study by UNCTAD has shown that a 10 per cent increase in oil prices would raise the cost of shipping a container by about 1.9 per cent to 3.6 per cent, and the cost of shipping one ton of iron ore and one ton of crude oil would increase by up to 10.5 per cent and 2.8 per cent, respectively.[4] These results entail implications for transport and trade if oil prices resume the upward trend observed over recent years and reach sustained high levels.[5]

17. Future increases in freight rates may be of particular relevance for lower-value goods and, more generally, for the trade of developing countries whose transport costs are already excessive. In this context, developing sustainable freight transport systems requires that the interplay between transport costs, energy security and price levels be better understood and their implications be taken into account when planning and investing in the development of more sustainable and resilient freight transport systems.

## D. Rising environmental sustainability and climate change concerns

18. Despite some positive developments, the world presently appears unlikely to achieve an average global temperature that would ensure that climate change remains manageable.[6] With climate change effects already being felt globally, freight transport systems – seaports in particular – are likely to be affected.

19. Port infrastructure is particularly vulnerable to climate change impacts (for example, rising water levels, floods, storms, precipitation and extreme weather events) and associated risks (for example, coastal erosion, inundation and deterioration of hinterland connections), given the location of ports in low-lying areas and deltas. Climate change impacts also affect shipping volumes and costs, cargo loading and capacity, sailing and/or loading schedules, storage and warehousing. These impacts impose investment and operating costs commensurate with the degree of exposure and vulnerability as well as the constraints that limit adaptive capacity.

20. While climate impacts on ports are localized, their effects may spill over borders, given the global economic interconnection through supply chains and international trade. This was recently illustrated by floods in Thailand that adversely affected computer components industries in distant locations in Europe and North America, for example. In view of the strategic role of ports as key infrastructural assets that link global supply chains and service international trade, it is necessary to incorporate sustainability and resilience criteria early on into transport planning and investment decision-making.

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[3] Figures published in the UNCTAD *Review of Maritime Transport 2012*, chapter 6, based on data from *2012 Key World Energy Statistics*, International Energy Agency.

[4] Oil prices and maritime freight rates: An empirical investigation (UNCTAD/DTL/TLB/2009/2), 1 April 2010.

[5] Ibid.

[6] International Energy Agency, 2013, *World Energy Outlook Special Report: Redrawing the Energy-Climate Map* (Paris, OECD/IEA).

**Box 1. Climate change implications for ports**

A study by OECD assessed the exposure of the world's largest port cities to coastal flooding in 2005 and has estimated the total value of assets exposed across all 136 port cities examined to be $3 trillion.[1] Another study examining the same 136 port megacities has found that, assuming a sea-level rise of 0.5 metres (m) by 2050, the value of exposed assets may be as high as $28 trillion.[2] Climate change widens the financing gap in transport, given prevailing global transport infrastructure needs that have been estimated at $11 trillion over the 2009–2030 period.[3] To close the gap of the large infrastructure deficit in developing countries, including in transportation, current estimates indicate that spending must reach $1.8–$2.3 trillion a year by 2020, compared with current annual levels of $0.8–$0.9 trillion.[4] Current carbon finance is inadequate to address transport needs.

Despite associated challenges, developments affecting transport and trade could also provide opportunities that would help advance the sustainability and resilience agenda. Such opportunities may arise, for example, in connection with the deeper regional integration and South–South cooperation observed over recent years, including the emergence of developing country banks. These developments may help mobilize additional funding to meet transport infrastructure investment needs, including sustainable freight transport infrastructure.

[1] OECD, 2007, Ranking of the world's cities most exposed to coastal flooding today and in the future, OECD Environment Working Paper No. 1 (ENV/WKP(2007)1).

[2] T Lenton, A Footitt and A Dlugolecki, 2009, *Major Tipping Points in the Earth's Climate System and Consequences for the Insurance Sector* (Gland and Munich, WWF and Allianz).

[3] OECD, 2011, *Strategic Transport Infrastructure Needs to 2030: Main Findings* (Paris).

[4] United Nations Development Programme, 2013, *Human Development Report 2013: The Rise of the South – Human Progress in a Diverse World* (New York).

# II. Geographically disadvantaged countries

## A. Landlocked developing countries

21. There are 44 landlocked countries in the world, 31 of which are classified as LLDCs: 15 in Africa, 10 in Asia, 2 in Latin America and 4 in Central and Eastern Europe. Sixteen of these landlocked countries are also classified as least developed countries (LDCs).[7]

22. Trade of LLDCs with overseas countries depends on the transport networks and available modes and routes of neighbouring transit countries. Developing sustainable transport solutions for LLDCs requires close cooperation with coastal transit neighbours leading to the joint design of, and planning and investments in infrastructure and services.

23. Because of the predominance of road transport and the absence or decline of competitive railway services in many transit systems, a main challenge for LLDCs is getting their goods to overseas markets as well as having to pay for the most expensive forms of transport operating with low unit loads and high manpower and equipment ratios.[8]

[7] This section draws heavily from UNCTAD's recent work on LLDCs, in particular chapter 6 of the *Review of Maritime Transport 2013*, *The Way to the Ocean* (2013) and Transport and logistics innovation towards the review of the Almaty Programme of Action in 2014 (TD/B/C.I/MEM.7/2), 13 August 2013. South Sudan is not included in these figures.

[8] For example, road transport in developing countries usually involves one container, one truck and one driver, whereas one ship can carry up to 18,000 containers and a crew of about 18 seafarers.

Road transport also entails high externalities, in terms of safety and environmental impacts, with the highest level of carbon dioxide emissions per metric ton carried among existing surface transport modes.

24. However, sustainable transport strategies could yield the biggest impact, precisely because of the long land distances involved in the context of transit transport. Distances to seaports for most LLDCs can be significant. At 3,750 kilometres (km), Kazakhstan is the furthest located from the sea, followed by Afghanistan, Chad, Niger, Zambia and Zimbabwe, with distances to the nearest coast in excess of 2,000 km. However, distance is only one topographical aspect of geography. The gentle slopes of the coastal plains are often in stark contrast to the steep mountainous interior that necessitates more fuel for transit purposes.

25. Some of the world's highest capital cities are those in LLDCs, for example: La Paz is 3,910 m high; Thimphu, 2,650 m; Addis Ababa, 2,355 m; Kabul, 1,800 m; Maseru, 1,673 m; Kigali 1,567 m and Harare, 1,500 m. Difficult terrain, poor road and railway conditions and inefficient institutional and operational transit frameworks undoubtedly contribute to increasing the difficulty to create sustainable and resilient freight transport systems.

26. While roads can be built and upgraded in stages, as demand or financing increases and their route may adapt to difficult terrain, rail systems require a strong upfront government commitment and funding. Rail also requires gentle gradients, and a path may be longer and less direct than a road. In many cases, differences in design and gauges arrangements required for invoicing and equipment exchange make it difficult to connect to rail tracks and services across borders within neighbouring countries. Long rail transport journeys also increase the impact of any disruption to trade by, for example, a natural disaster that severs a railway line. Resilient freight transport systems thus need to be developed, catering for unexpected, though anticipated, events. Differences between rail and road transport systems suggest that solutions adopted with a view to ensuring more sustainable and resilient land transport systems need to be designed and tailored to effectively reflect the prevailing local conditions.

27. By raising costs and undermining trade, the unreliability of services, uncertainty and revenue loss associated with longer journeys and the use of outdated equipment and vehicles further challenge the sustainability and the resilience agenda in freight transport. Long distances also mean fewer journeys for any given vehicle during a defined period, thus limiting revenue per customer and often empty backhauls leading to lesser returns on investment for the owner. Such realities dissuade transport companies from renewing their fleets, leading to low quality of service provided by old, unreliable and high-carbon polluting stock. In some cases, protectionist regulations inadvertently defend the use of aging trucking fleets. Private sector service providers, operating under the protection of restrictive regulatory schemes, can obtain monopolistic or oligopolistic positions, which may make them strong opponents to efforts to bring about transparency and simplicity to the transit system.

28. The longer the road or the rail track and the increased uncertainty of transit transport times, the greater the possibility of unforeseen events: mechanical failures or accidents that may result from driver fatigue, or from poor road or rail maintenance. Long routes are also a risk factor for theft and numerous stops due to checkpoints along the road, including weighbridges or stops at railway stations, and of course border crossings. As a result of these long delays and uncertainties, traders in LLDCs may have to support considerable inventory costs reaching more than 10 per cent of the value of the goods. The unreliability of the transit logistics system is also the foremost impediment for manufacturers in LLDCs to enter value chains, at both the regional and global levels.

## B. Small island developing States

29. Challenges undermining the sustainable development of SIDS are recognized by the Programme of Action for the Sustainable Development of Small Island Developing States (Barbados Programme of Action), the Mauritius Strategy for the Further Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States and its subsequent reviews, and more recently, in the context of the post-2015 development agenda.

30. SIDS share a number of common features that exacerbate their sustainable development challenges, including small population, low availability of resources, limited domestic markets, remoteness from trade partners, susceptibility to natural disasters, excessive dependence on international trade and vulnerability to global economic shocks. Most of those States suffer from high transportation and communication costs mainly related to the difficulties in benefiting from economies of scale. By attracting transhipments, some island economies such as Jamaica, the Bahamas, Trinidad and Tobago or Mauritius have managed to develop hub ports, effectively helping improve shipping connectivity for national traders. High trade logistics costs are compounding the economic and environmental vulnerabilities of SIDS, including their heavy reliance on fossil fuel imports and their susceptibility to weather events and natural disasters.

31. SIDS transport issues are unique, given their size and the difficulties faced in adjusting to a world increasingly driven by technologies and larger-scale operations. For example, port cargo handling charges in the Caribbean SIDS are estimated to vary between $200 and $400 per container, compared for example, with $150 per container charged in Argentina.[9] Similarly, the cost of transport and insurance is reported to be some 30 per cent higher than the world average.[10] Freight rates between Miami, Florida and the Caribbean are similar to those paid for the much longer distance between Miami and Buenos Aires.[11] A container shipped between the port of Shanghai and the port of Los Angeles over a distance of over 19,000 nautical miles attracts a freight rate of approximately $700, whereas a box shipped from the port of Kingston in Jamaica to Orangestead in Aruba over just 513 nautical miles attracts an average freight rate of $2,800.[12]

32. Low cargo volumes, small domestic markets and limited export product diversification have contributed to marginalizing a great number of SIDS from global trade and value chains. Despite their openness to trade, SIDS economies have not recorded significant gains in terms of trade, whether regional or interregional.[13] Therefore, their growth potential is undermined, especially as they also lack trade-product complementarity to foster intraregional trade and depend on preferential market access schemes granted by developed market economies. In 2012 for example, SIDS contributed 0.15 per cent of global exports with 92 per cent of total flows being destined to markets outside SIDS.[14]

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[9] FH Pinnock and IA Ajagunna, 2009, *The Caribbean Maritime Transportation Sector: Achieving Sustainability through Efficiency*, Caribbean Paper No. 13, (Waterloo, Ontario; The Center for International Governance Innovation).

[10] Ibid.

[11] Ibid.

[12] FH Pinnock and IA Ajagunna, 2012, Maritime highway corridors into the Caribbean seas: Perspective on the impact of the opening of the expanded Panama Canal in 2014. In: Alix Y, ed., *Les corridors de transport* (Cormelles-le-Royal, France, Les éditions EMS).

[13] Economic Commission for Latin America and the Caribbean, 2002, The effects of globalization on CARICOM Caribbean economies, chapter 11. In: Globalization and development (LC/G.2157(SES.29/3)).

[14] *UNCTADStat*. See http://unctadstat.unctad.org/.

During the same year, the share of trade within the Caribbean Community (CARICOM) for example, remained steady but negligible, averaging 14.5 per cent.[15]

33. Since SIDS are sea locked, climatic factors that may have a severe impact on coastal transport infrastructure and services pose serious threats to their prospects for economic development. For example, as a result of the 2004 Indian Ocean tsunami, the Maldives lost more than 60 per cent of its gross domestic product (GDP), and its graduation from LDC status was delayed.[16]

34. Because their adaptive capacity is particularly constrained by their economic vulnerability, the implications of any climate-induced damage or disruption to transport networks, including ports, can be detrimental to SIDS. The strong interdependence between the tourism and transportation sectors magnifies the challenge, as negative impacts of climate change factors on any one of these sectors would ultimately lead to the collapse of the other. Thus, adaptation to climate change impacts and building the resilience of freight transport systems in SIDS is not only a sustainable development challenge but also a survival issue.

**Box 2. Climate change impacts in the Caribbean**

In the Caribbean SIDS for example, potential losses resulting from unmitigated climate change impacts on transportation are estimated to reach 14 per cent of the region's GDP by 2025.[1] One study finds that a one-metre sea-level rise in CARICOM will cause a severe disruption of transportation networks, including a 10 per cent loss of CARICOM island airports and inundation of the land surrounding 14 ports, as well as road reconstruction costs of over $178 million.[2] In the meantime, in some Caribbean SIDS including Jamaica, massive transport infrastructure plans are under way, involving the expansion of port-capacity and channel depths to keep pace with expected trade growth resulting from the enlargement of the Panama Canal. Climatic factors could seriously jeopardize these investments, if they are not sustainable, climate proof and resilient. While some studies have estimated the cost of protecting the coasts of Jamaica from a sea-level rise of one metre at $462 million,[3] these amounts are dwarfed by the value of projected infrastructure expansion plans.

[1] MC Simpson et al., 2009, *An Overview of Modelling Climate Change Impacts in the Caribbean Region with Contribution from the Pacific Islands* (Barbados, United Nations Development Programme,)

[2] "The Vulnerability of Caribbean Ports to the Impacts of Climate Change: What are the Risks?" Presentation by L Nurse at the UNCTAD Ad Hoc Expert Meeting on Climate Change Impacts and Adaptation: A Challenge for Global Ports, 29–30 September 2011, Geneva, Switzerland.

[3] Climate Studies Group Mona, 2012, *State of the Jamaican Climate 2012: Information for Resilience Building – Summary for Policymakers* (Kingston, Planning Institute of Jamaica).

35. Challenges arising from climate change impacts on coastal systems and infrastructure have been highlighted during SIDS regional and interregional preparatory meetings leading up to the Third International Conference for Small Island Developing States to be held in Samoa in September 2014. Many SIDS are of the view that their classification as either middle-, upper-middle, and, as applicable, high-income countries, limits access to vital concessionary and development financing.[17] Consequently, many

[15] Ibid.

[16] Economic and Social Commission for Asia and the Pacific and United Nations Office for Disaster Risk Reduction, 2012, *Reducing Vulnerability and Exposure to Disasters: The Asia-Pacific Disaster Report 2012* (Bangkok).

[17] Small Islands Developing States (SIDS) integrated and enabling cooperation framework for the Barbados Programme of Action and Mauritius Strategy for the Further Implementation, Outcome of

SIDS are calling for new and additional predictable financial sources for sustainable development, including through relevant regional financing mechanisms.

# III. Enabling sustainable and resilient freight transport systems

## A. Building capacity and multi-stakeholder collaboration

36. Transportation in general and freight transport systems in particular have an important role to play in addressing the sustainability and resilience agenda. However, for 2this role to materialize, relevant sustainability and resilience criteria need to be integrated and mainstreamed into freight transport planning, policies and investment decisions. Adopting a multi-stakeholder approach involving governments, transport industry, financial institutions and other relevant partners is imperative for these efforts to be successful.

37. As early as 2003, UNCTAD developed a supply-chain management approach to be applied by stakeholders along transit corridors to acquire a comprehensive understanding of their respective individual roles in the whole transit supply chain. It revealed the impact of the actions of their members on the performance of various stages along the transit chain, as well as the benefits accruing from collectively optimizing the chain as a whole, as opposed to trying to maximize individual returns. Such collaborative schemes constitute an essential step towards building a new vision and common goals to achieve sustainable and resilient systems with the common aim of ending the unreliability of transit operations.

38. After many years of continuous efforts and despite the progress achieved to date in many aspects, comprehensive effective solutions to improve transit systems for LLDCs may still require crosscutting market regulatory reforms. Such reforms should aim at creating sustainable and resilient freight transport systems, an achievable target, provided that LLDCs and their transit neighbours work together towards this goal.

39. Tailored and targeted policies, regulations, incentives and programmes will be required to promote more efficient, competitive, less energy-intensive and more environmentally friendly freight transportation systems. Various strategies could be pursued to enable sustainable and resilient freight transport systems. Potential areas of intervention include, for example:

(a) Integrating transportation and land-use planning;

(b) Balancing transport modes;

(c) Shifting to lower carbon fuels;

(d) Promoting energy-efficient transport technologies;

(e) Scaling up investment in transportation infrastructure;

(f) Promoting infrastructure maintenance and management;

(g) Rethinking supply-chain designs including the location of production sites;

(h) Collecting and sharing relevant data and using performance indicators;

(i) Reshaping transport architecture and networks;

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the Interregional preparatory meeting for the Third International Conference on Small Island Developing States, Bridgetown, Barbados, 26–28 August 2013.

(j) Improving cooperation and stakeholder networking;

(k) Promoting trade facilitation measures that reduce border delays and inefficiencies;

(l) Rerouting trade to ensure the most energy efficient and less carbon-emitting trajectory.

40. As regards the sequence required to respond to the climate-change challenge in particular and to build the climate resilience of freight transport systems, a first step would involve enhancing the understanding and technical knowledge among policymakers, transport planners and transport-infrastructure managers of climate change impacts on coastal transport infrastructure, services and operations. The next step would be to strengthen their capacity to make informed decisions and take effective and appropriate climate-policy response and adaptation measures. Conducting risk assessments for critical transport infrastructure and facilities, especially in ports, will be crucial to ensure that adaptation measures adopted are tailored to reflect the local conditions, especially in developing regions. However, to be more effective, enhancing adaptive capacity requires that actions be integrated with other policies such as disaster preparedness, land-use planning, environmental conservation, coastal planning and national plans for sustainable development.

41. As LLDCs and SIDS are disproportionately vulnerable to climate change impacts, building the climate resilience of their transport infrastructure and services is core to their sustainable development and rests heavily on building their economic resilience. For both these groups of developing countries, coordinated regional action supported by the international community would help optimize the use of resources.

42. Finally and as emphasized repeatedly, including at the UNCTAD high-level panel discussions, "Paving the Way to Sustainable Freight Transport", held during UNCTAD XIII, in Doha, in April 2012, collecting, sharing and disseminating relevant transport and climate data is necessary, as is bridging the gap between academic research interests and industry.

## B. Optimizing data use

43. The advent and widespread adoption of new technologies has enabled cost savings through the better management of existing transport systems. For instance, satellite navigation has helped transport operators better plan their journeys and utilize their assets more efficiently, leading to fuel savings and an increased predictability of journey times. For warehouse managers, technology has allowed intelligent stock ordering to ensure facilities are kept at optimum levels, ensuring complex coordination of cargo storage and handling operations.

44. An issue not yet fully exploited is the use of data derived from the implementation of technology by third parties. For example, data from satellite navigation users could be useful to predict traffic flows, congestion times and even the viability of providing particular services along certain routes. Data from government agencies such as customs could be used to give proxy for processing time of cargo through ports or across borders. Insight gained from data collected and related analyses will help improve understanding of freight transport systems and ways in which they can be made more sustainable and resilient.

45. Policy planners could help identify bottlenecks and eliminate problems to create a seamless flow of traffic and goods. The establishment of a data centre on a national or regional basis to collect information on empty trucks along transit corridors could enable

higher utilization rates, increase exports and lower transport costs for LLDCs. Dedicated transport observatories could be established with the task of identifying opportunities for maximize existing assets.

46. In addition, building institutional capacity through corridor management arrangements will bring on a change of culture that encourages the confidence of shippers and carriers, operating in a setting that rewards compliant behaviour, builds trust and attracts investment, promotes larger scale trade operations, improves transport service quality and reliability, and enables strong cooperation among stakeholders along transit corridors, including ports, serving transit trade to and from LLDCs.

47. Data on port performance currently collected by ports and terminals, but not openly shared, could be published to highlight best practices and show where investments could have the maximum impact. All these improvements can lead to lower transport costs and better trade competitiveness on a country level.

## C. Mobilizing finance

48. It has been estimated that capital investment in global transport varies between $1.2 trillion and $2.4 trillion annually.[18] The development of global land transport infrastructure alone is expected to reach as much as $45 trillion (in capital construction) by 2050 (under a "4C" or "4DS" business-as-usual scenario).[19] When combined with operations, maintenance and repairs, land transport investment is expected to reach nearly $120 trillion by 2050 under the same scenario.[20] By 2050, the potential shift to sustainable transport (under a "2C" or "2DS" scenario) could result in as much as $20 trillion (over baseline projections) worth of savings in terms of global land transport infrastructure investments and maintenance costs.[21] More than 20 per cent of these cumulative savings could result from reduced roadway investment and maintenance costs.

49. In view of these significant investment and cost implications, as well as the long life cycles of transport assets that can lock in unsustainable technologies and processes for extended periods, it is important that freight transport infrastructure and systems take into account sustainability and resilience criteria at the early stages of investment and development planning. This will prevent future costly retrofitting of equipment and infrastructure and adjustment of operations and services. Since in many developing countries transport infrastructure plans are currently being drawn up, these countries have the opportunity to consider from inception a sustainable approach for transport development and to progress towards a sustainable, greener, low-carbon and more climate-resilient development pathway. Not seizing this opportunity may lead to increased costs in the future.

50. In this context, requisite funding and investments need to be further mobilized with a view to enabling the development of sustainable and resilient freight transport systems. Scaling up investments, including through new sources and mechanisms, and promoting a

[18] B Lefevre, B Leipziger and M Raifman, 2014, The trillion dollar question: Tracking public and private investment in transport, Working Paper, World Resource Institute, available at http://www.wri.org/publication/trillion-dollar-question.

[19] J Dulac, 2013, *Global Land Transport Infrastructure Requirements: Estimating Road and Railway Infrastructure Capacity and Costs to 2050* (Paris, OECD/International Energy Agency), available at http://www.iea.org/publications/freepublications/publication/TransportInfrastructureInsights_FINAL_WEB.pdf.

[20] Ibid.

[21] Ibid.

collaborative approach between public and private investment partners to meet the increased investment requirements for more sustainable transport patterns is crucial.

**Increasing public finance**

51. Public finance has traditionally played a key role in developing transport infrastructure, being by nature for the public good and providing high economic and social benefits. Domestic public finance (using both domestic and international flows, such as official development aid) remains an essential source of financing for the transport sector, namely for infrastructure construction and maintenance. Countries typically spend 2–13 per cent of their public budgets on transport,[22] a share that is dwarfed by the scale of investments required for the development of sustainable and resilient freight transport systems.

52. Governments need to embrace new and innovative sources of finance, as has been the case for some developing countries that, building on their improved macroenvironment, have succeeded in mobilizing finance from different sources, such as the capital market, and a variety of financial instruments, such as infrastructure bonds.

53. Infrastructure bonds are a debt instrument issued by governments or private companies to raise funds from the local or international capital markets for infrastructure projects. The interest payments associated with infrastructure bonds (and repayment of the principal debt) are secured by, or serviced from, the cash flows generated by the underlying specific project or a portfolio of projects – such as a toll road.[23] Countries such as Brazil, Chile, Hong Kong (China), Malaysia and the Republic of Korea have been successful in using project finance bonds as a way to catalyse investor interest in infrastructure projects.[24]

54. Nevertheless, not all countries have adopted the same approach when dealing with infrastructure bonds. For example, in Cameroon, Kenya and South Africa, Governments have issued government bonds with a promise to invest the funds in infrastructure development. As the bonds have no income stream associated with the underlying assets, cash flows for the bonds are paid directly out of government tax revenues. In this context, government credibility is a critical factor to ensure investor confidence, particularly when issuing future bonds and creating a viable infrastructure bond market.[25] Kenya, for example, has raised $1 billion through infrastructure bonds over the past few years to fund various infrastructure projects, including roads. Since late 2010, Cameroon has raised CFA 250 billion (around $520 million) on the bond market to finance a deep-sea port and road improvements among other infrastructure projects.[26]

55. Infrastructure bonds are considered to be an efficient form of financing transport infrastructure, as they reflect the long-term nature of the financing, which is often not available or difficult to obtain from other sources of finance. Best practices have shown that

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[22] Figures published in UNCTAD *Review of Maritime Transport 2012*, chapter 6, based on the Institute for Transportation and Development Policy report available at http://www.itdp.org/documents/A_Paradigm_Shift_toward_Sustainable_Transport.pdf.

[23] CA Mbeng Mezui, 2013, Unlocking infrastructure development in Africa through infrastructure bonds, *GREAT Insights*, 2(4), May–June.

[24] CA Mbeng Mezui and B Hundal, 2013, Structured finance conditions for project bonds in Africa markets (Tunis, African Development Bank), available at http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Structured%20Finance%20-%20Conditions%20for%20Infrastructure%20Project%20Bonds%20in%20African%20Markets.pdf.

[25] CA Mbeng Mezui, 2013, op. cit.

[26] See http://www.reuters.com/article/2012/02/20/cameroon-bond-idAFL5E8DK33720120220.

sound macroeconomic policies, appropriate legal and regulatory frameworks, well-developed local institutions, as well as a dynamic private sector, are important for the promotion of sustainable infrastructure bond markets and as such, constitute a lesson for other developing countries to follow.[27]

**Box 3. Green bonds as a source of financing the transition to a low-carbon, climate-resilient transport**

Recent years have seen the emergence of green bonds (also known as climate-theme bonds) which are similar to traditional bonds, except that their proceeds are exclusively used to finance environmental projects. These may include energy efficiency, renewable energy, transportation, green growth, clean air and water, mitigation of greenhouse gas emissions and similar activities.

These bonds can be issued by governments, the private sector, commercial banks and international financing institutions (for example, the World Bank). International financing institutions have been very active in this sector. In 2008, the World Bank issued its first labelled green bonds and, since then, has made over 40 additional issues worth $4 billion.[1] In 2013, the value of green bonds issued globally was estimated at around $14 billion and this is expected to double in 2014. In addition, green bonds are projected to potentially account for 10–15 per cent of global bond issuance within five to seven years.[2]

The development of a market for green bonds is supported by the International Climate Bonds Initiative, an international network comprising a group of more than 50 leading finance and climate experts, together with the world's largest institutional investors. One of the Initiative's key projects is the creation of an International Standards and Certification Scheme that will promote the integrity and liquidity of this important market.[3]

Green bonds are emerging as a key source of finance to fill in the investment gap and attract private sector and institutional investment into environmental initiatives through the issuance of debt instruments. They are still relatively new and have yet to conform to a standardized format. However, the International Climate Bonds Initiative is developing eligibility criteria for the certification of low-carbon transport-related bonds, which would provide investors with assurance about the environmental benefits of specific projects and would stimulate further investments in low-carbon and green transport in coming years.

[1] TD Economics, 2013, Special report, Green bonds: Victory bonds for the environment, available at http://www.td.com/document/PDF/economics/special/GreenBonds_Canada.pdf.

[2] See http://www.ft.com/intl/cms/s/0/1fb827d6-5789-11e3-86d1-00144feabdc0.html#axzz2rcIF3r8P.

[3] S Kidney, S Clenaghan and O Padraig, 2012, Climate bonds – The investment case, chapter 16. In: The Climate Bonds Initiative, available at http://www.climatebonds.net/wp-content/uploads/2012/05/Will-O-Climate-Bonds-Chap16-1.pdf.

**Public–private partnerships**

56. Given the limited availability of public sector funds, developing countries have been increasingly scaling up public contribution with private sector investment and expertise through public–private partnerships (PPPs). PPPs have, in the last two decades, emerged as

[27] CA Mbeng Mezui, 2012, Accessing local markets for infrastructure: Lessons for Africa, Working Paper No. 153, available at http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Working%20Papers%20Series%20153%20-%20Accessing%20Local%20Markets%20for%20Infrastructure%20Lessons%20for%20Africa.pdf.

a mechanism to leverage greater private investment participation and most importantly to access specialized skills, innovations, and new technologies associated with infrastructure development, operation and maintenance. As today's transport systems require highly specialized managerial and operational skills, as well as cutting-edge technologies, the expertise of private partners for building, operating and maintaining transport infrastructure and services is significant and constitutes an important resource to draw from, in addition to finance. Over the 1990–2012 period, private sector participation in transport projects is estimated to have increased fivefold.[28] While there is no one universal definition of PPPs, a widely accepted definition refers to PPP in infrastructure as a mechanism for the "creation and/or management of public infrastructure and/or services through private investment and management for a predefined period and with specific service level standards".[29] As such, PPPs can vary by shape and size, ranging from small service contracts to full-blown concessions, greenfield projects and divestitures.

57. Governments can build on the various extensive PPP models and make them a viable and effective tool for the development of sustainable and resilient freight transport systems. Important prerequisites for a successful PPP include well-designed contracts to ensure appropriate risk sharing and flexibility, clear policy framework, a legal and regulatory system that ensures contracts are effective and enforceable, a long-term investment plan and a governmental operating and institutional framework to properly manage the process.

[28] Figures from the World Bank, published in Lefevre et al., 2014.

[29] Definition published in UNCTAD, *Review of Maritime Transport 2012*, from a presentation entitled "Public–in Infrastructure in India", delivered by A Mayaram, Additional Secretary, Ministry of Rural Development, Government of India, at the UNCTAD Multi-year Expert Meeting on Investment for Development, February 2011.

**Box 4. Financing regional, cross-border transport projects**

The inadequate and inefficient provision of regional/subregional transport infrastructure networks and services in many developing countries is a barrier for sustainable economic growth and trade expansion. Transport networks are in many cases inefficient or poorly maintained and require substantive finance.

Financing regional transport projects presents, nevertheless, particular challenges in comparison to single-country projects due to additional risks or externalities, such as massive investment requirements, higher transaction costs, varying regulatory regimes and complex risk factors. Effective cooperation and coordination is therefore required among countries, including the availability of regulatory frameworks across region/subregions to facilitate regional infrastructure projects.[1]

Some regional initiatives have emerged in recent years to help promote regional transport development. Most of these initiatives are driven by regional organizations and development banks. For example, the Association of Southeast Asian Nations (ASEAN) Infrastructure Fund was jointly set up by the Association's member States and the Asian Development Bank, with an initial equity base of $485 million (of which $335 million is provided by ASEAN members and the remaining $150 million by the Asian Development Bank). This Infrastructure Fund supports implementation of the Master Plan on ASEAN Connectivity by lending $4 billion to ASEAN members up to 2020. Moreover, the three African trading blocs, the Common Market for Eastern and Southern Africa, the Southern African Development Community and the East African Community are considering issuing joint regional infrastructure bonds as one of the options of raising funds to improve infrastructure in the region (the cost is estimated to be $93 billion over the next decade). This includes raising funds for key projects on the Northern, Central, Lamu and Djibouti corridors.[2] Other examples include the African Development Bank initiative Africa50, launched in 2013 as a one-stop shop that will prepare regional infrastructure projects and sell bonds to raise funding for project investment. As a separate corporate entity, Africa50 may avoid some of the prudential funding limits that restrict the African Development Bank's participation in such projects.[3]

Other initiatives for PPP development include bilateral or multilateral special-purpose vehicles being established by the Economic Community of West African States and the Southern African Development Community to overcome the high risks and transaction costs of private investment in regional infrastructure projects.[4]

Regional development banks, such as the African Development Bank, the Asian Development Bank, and the Caribbean Development Bank, are also expanding their activities in PPPs and providing technical assistance to build capacities and support the financing of private sector investment in PPPs.

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[1] See http://www.commonwealthministers.com/images/uploads/documents/Brixiova_9.pdf.

[2] See http://www.theeastafrican.co.ke/business/Comesa++SADC++EAC+now+planning+regional+infrastructure+bonds+/-/2560/1246542/-/view/printVersion/-/10ffy8nz/-/index.html.

[3] For further information, see http://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/africa50-infrastructure-fund.

[4] See http://www.commonwealthministers.com/images/uploads/documents/Brixiova_9.pdf.

# IV. Concluding remarks

58. For the freight transport sector in all countries, particularly LLDCs, transit countries and SIDS, to play an effective role in addressing the sustainability and resilience agenda, further analysis is required to clarify potential needs and requirements for sustainable and resilient freight transport systems. Such research will also have to explore ways in which funding and investments can be mobilized and directed to support their development as well as to examine the role of the private sector, including through PPPs and/or new sources of finance, such as climate finance.

59. UNCTAD, in accordance with its mandate, and with special attention to the needs of the most vulnerable economies, in particular LDCs, LLDCs and SIDS, is increasingly considering the linkages between the economic, environmental and social dimensions. More specifically, UNCTAD, through its three pillars of work, is dedicating particular attention to these issues and is helping developing countries to improve their understanding of key underlying considerations and to build their capacity to effectively mainstream the concept of sustainability and resilience into their transport policies and financing decisions, as well as to develop appropriate tools and mechanisms to accomplish this.

60. This is illustrated by current research and analytical work, including on sustainable freight transport, the international legal framework governing the international liability and compensation for ship-source oil pollution, and more importantly, the impact of climate change on maritime transport and hinterland connections and associated adaptation requirements.

61. UNCTAD is also pursuing its work with a view to helping developing countries devise policy options to cushion the effects of rising and volatile oil prices on transport and trade costs, and develop policies and response measures that will help cut transport costs and improve transport efficiency and connectivity.

62. For many LLDCs, the design of sustainable and resilient transit transport systems may also require profound regulatory reforms to open regional transport markets. These reforms should enable a more efficient use of deployed transport means, address prevailing trade imbalances, as well as limit inefficient empty returns in road and rail transport that reduce turnarounds of equipment, compress returns on investment and raise already high freight rates. UNCTAD continues to assist developing countries, in particular LLDCs and their transit neighbouring countries, in addressing these pertinent concerns.

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# Developing sustainable and resilient transport systems in view of emerging challenges

## Note by the UNCTAD secretariat

**Corrigendum**

**Paragraph 26**

The third sentence *should* read

In many cases, differences in design and gauges, as well as in invoicing and equipment exchange arrangements, make it difficult to connect to rail tracks and services across borders within neighbouring countries.

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